Forward Vertex Tracking Detector (FVTX) Intro

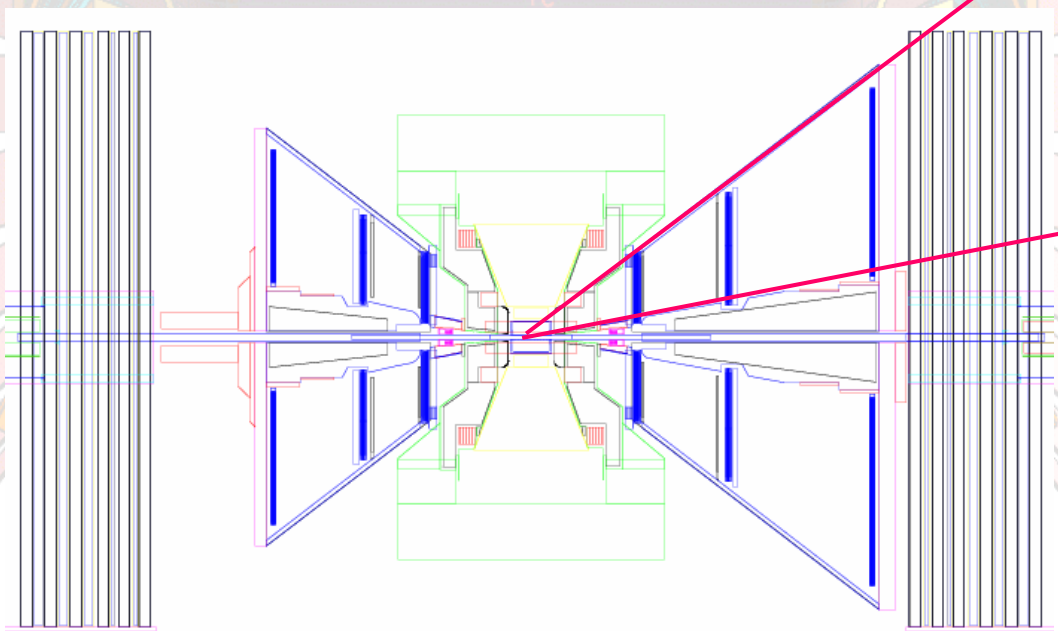
Melynda Brooks, LANL
Forward Vertex Detector Review
BNL, 14-March-2006

Brief Outline:

- Where?
- Why?
- What?
- Who?
- How Much?
- How Long to Build?

General

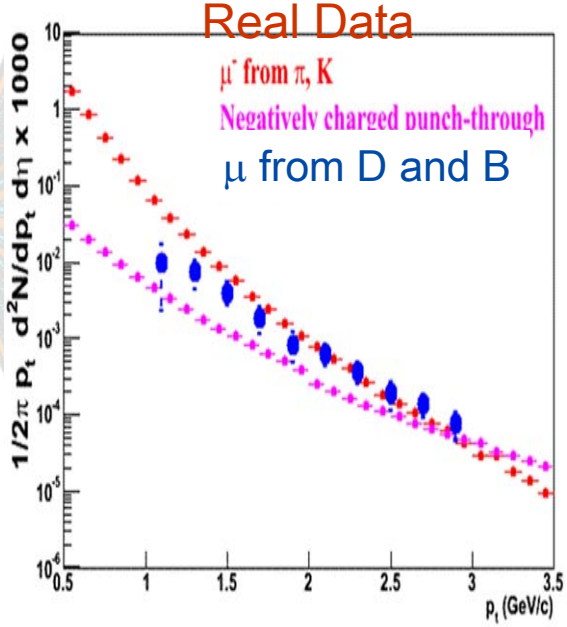
- Silicon Vertex Tracker for Forward Rapidity:
  - Greatly enhances physics reach of PHENIX Muon System
  - Complements Barrel Tracker which will cover central rapidity
  - 4 layers of silicon accurately measuring vertex displacement, track trajectory at forward rapidity



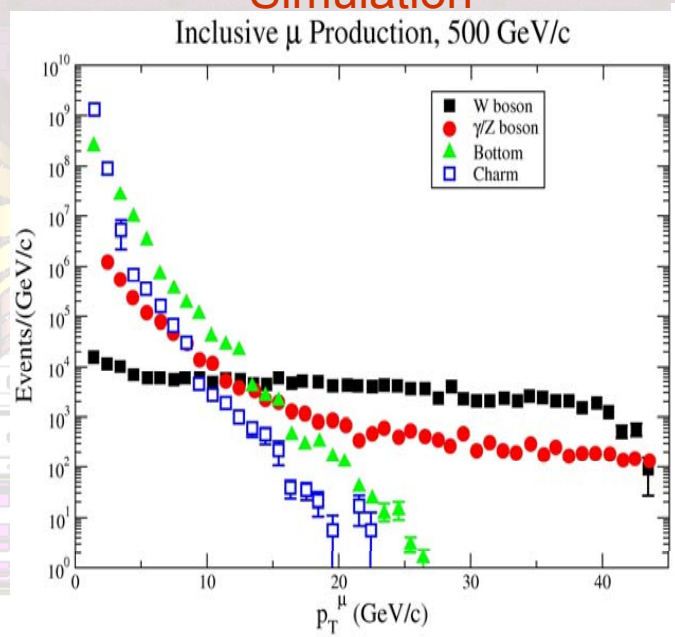
Why?—Improvement of Forward Rapidity Muon Measurements

- Physics observables with Muon Arms plus FVTX:
  - Vector Mesons
  - Open heavy flavor
  - Hadrons

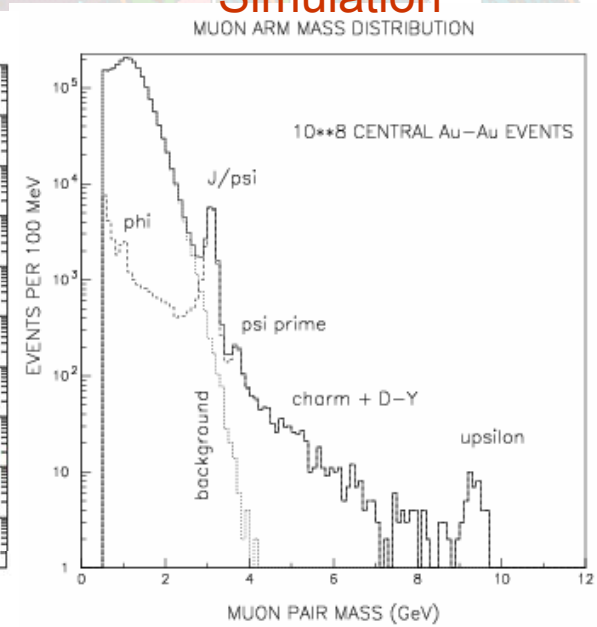
Real Data



Simulation



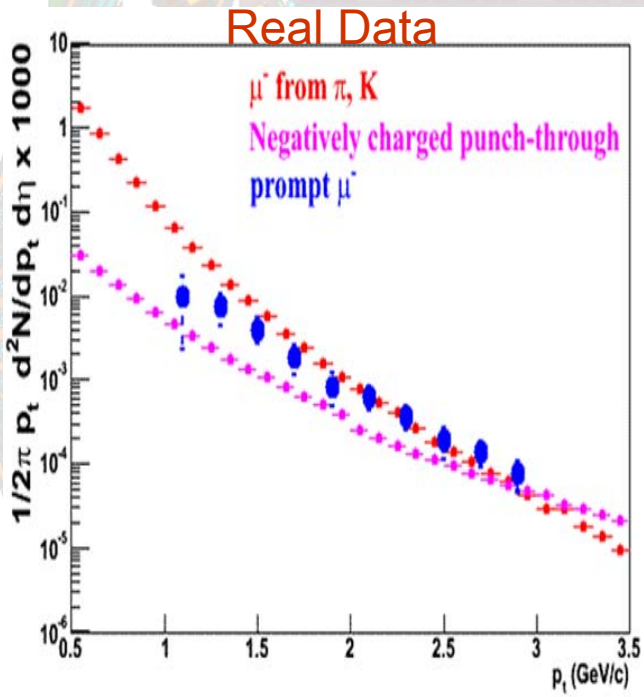
Simulation



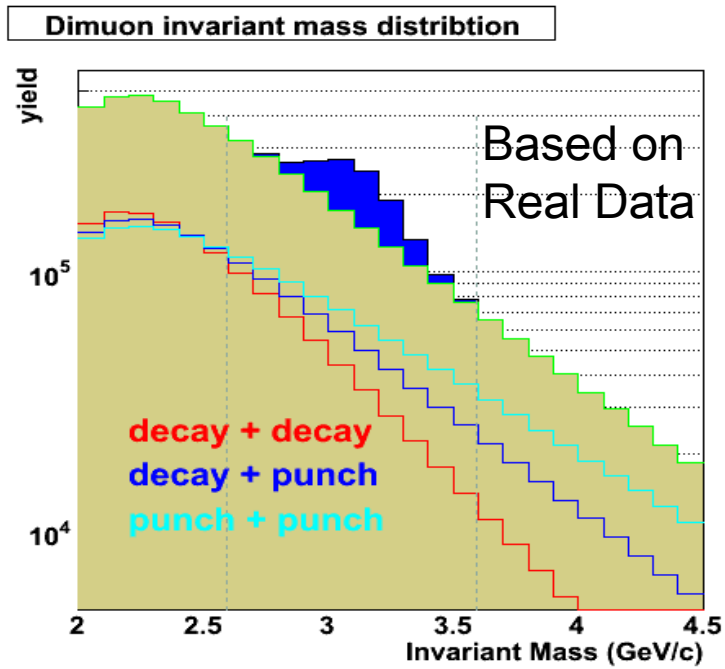
Each and every physics measurement from the muon arm will be improved with the addition of the FVTX and new measurements will become available

Why?—Limitations of Current Measurements

- Many current measurements with PHENIX detector are quite limited because of large systematic errors associated with large backgrounds



Single Muon Spectra

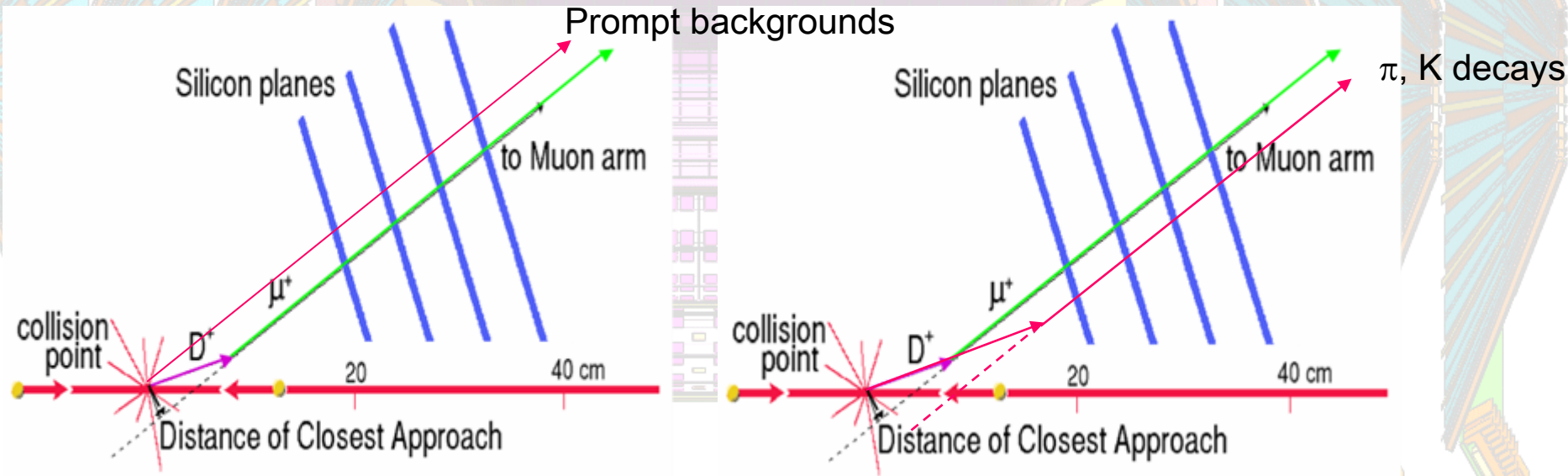


MB AuAu J/ψ with Background

How FVTX Can Help

- Significant reduction of backgrounds by accurately measuring the Distance of Closest Approach (DCA). Decay muon, punch-through hadron, and open heavy flavor decay muons can be separated on a track-by-track basis

- Significant improvement in angular resolution of track leading to improvement in dimuon resolutions

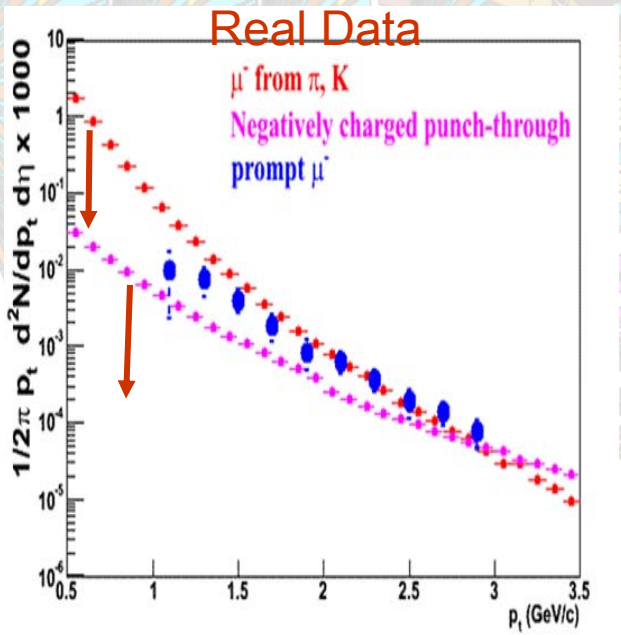


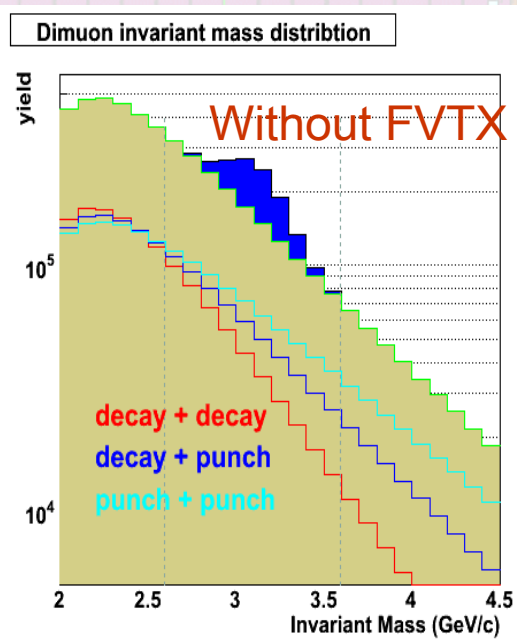
Xiaorong will present simulated performance

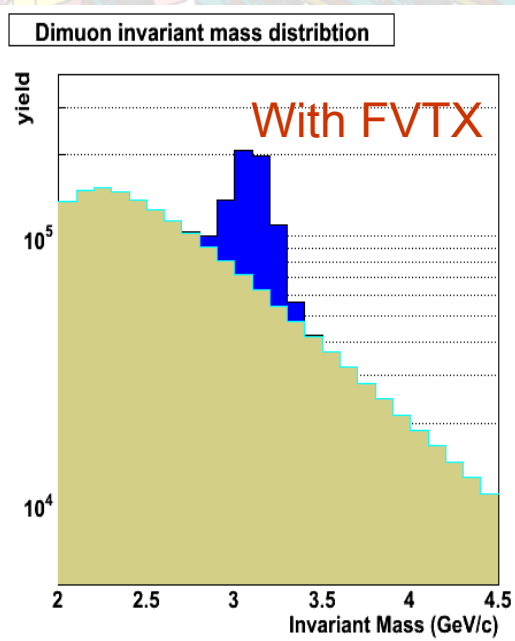
How FVTX Can Help

- Single muon components can be separated from each other, greatly reducing systematic errors on open heavy flavor measurements

- Decay muons can be removed from dimuon background and dimuon mass resolution will improve. All dimuon measurements (vector mesons, Drell-Yan, correlated and uncorrelated open heavy flavor) will have less background



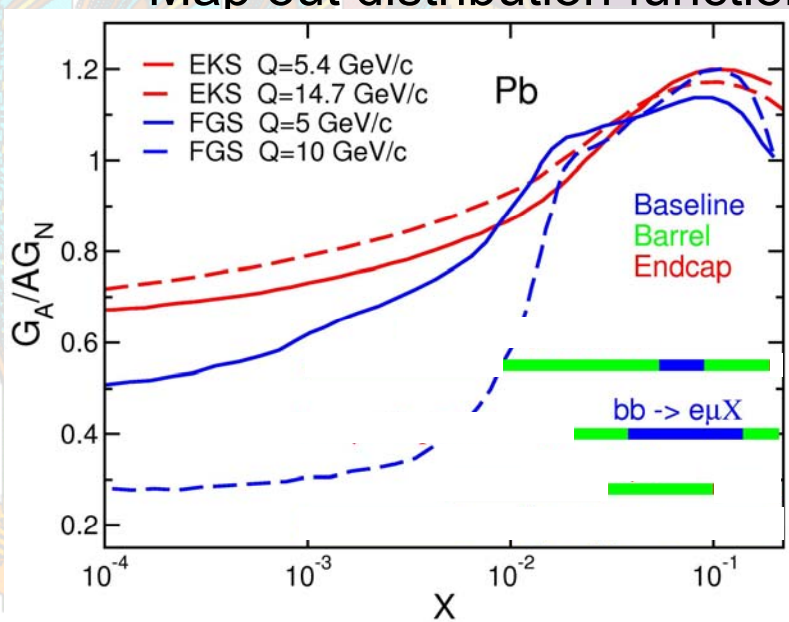


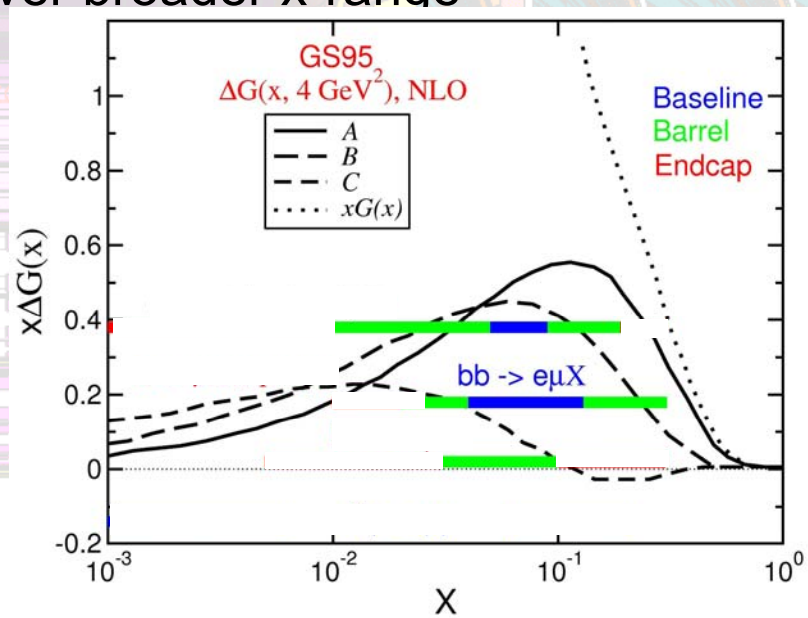


Why Forward Rapidity?

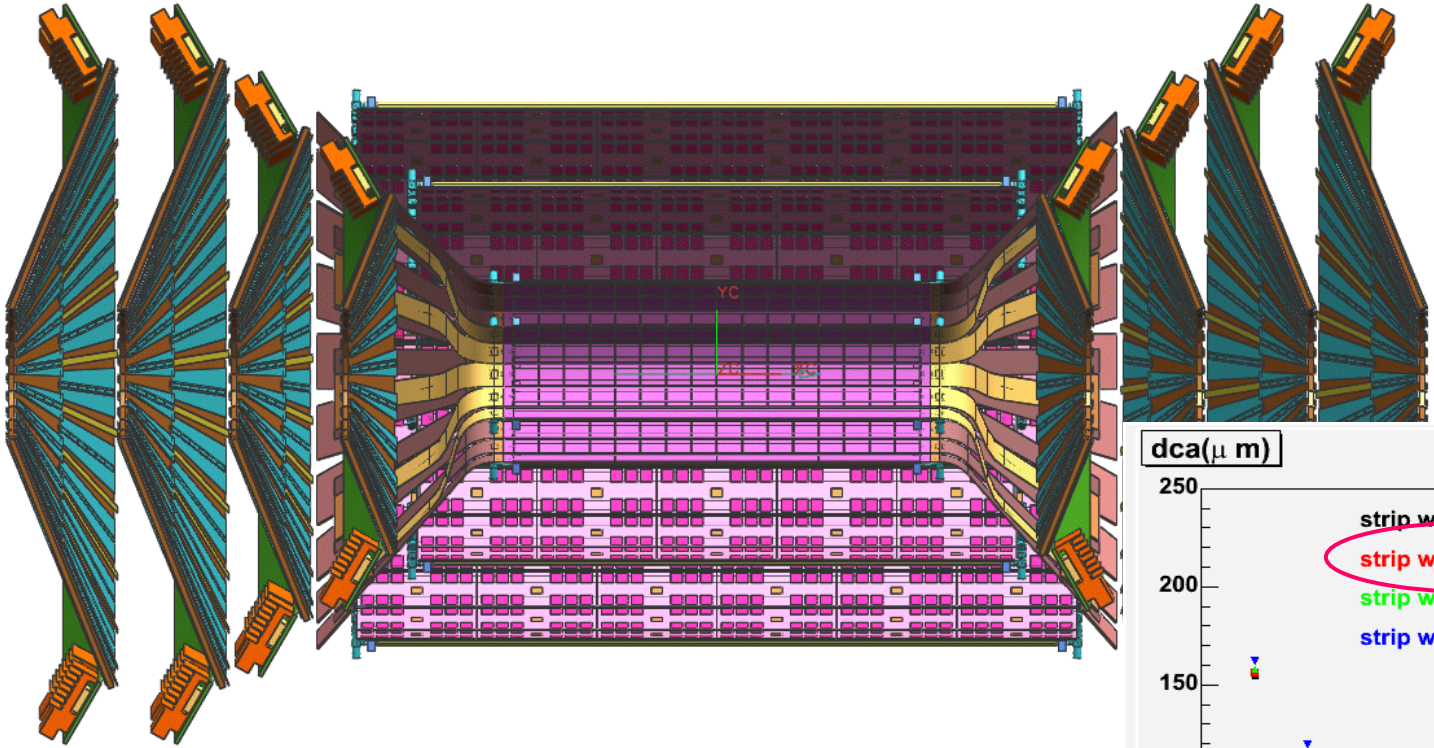
- Improvement in rich Muon-Arm physics program:
  - pp, dAu, AuAu programs all improved significantly

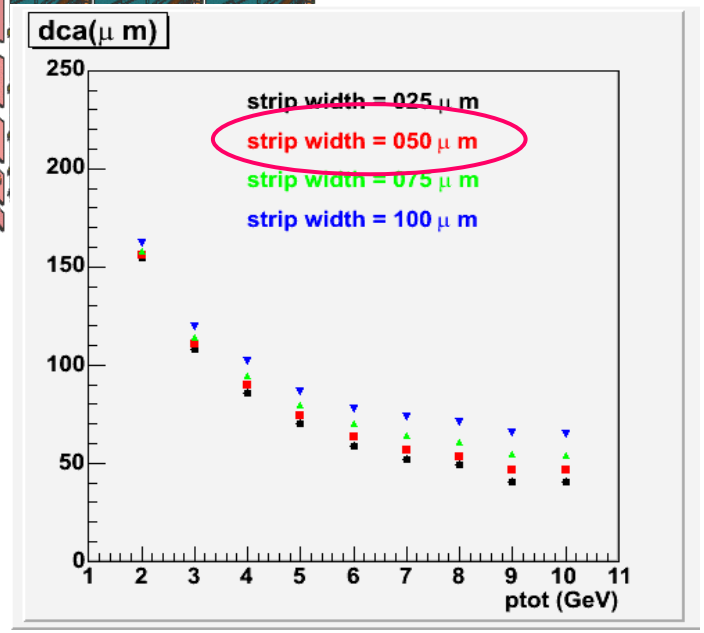
- Forward Rapidity brings critical kinematic extension with much better systematic errors than current measurements to:
  - Separate various cold- and hot-nuclear matter effects
  - Map out distribution functions over broader x-range





What?—FVTX Design





Gerd will give details

Who?

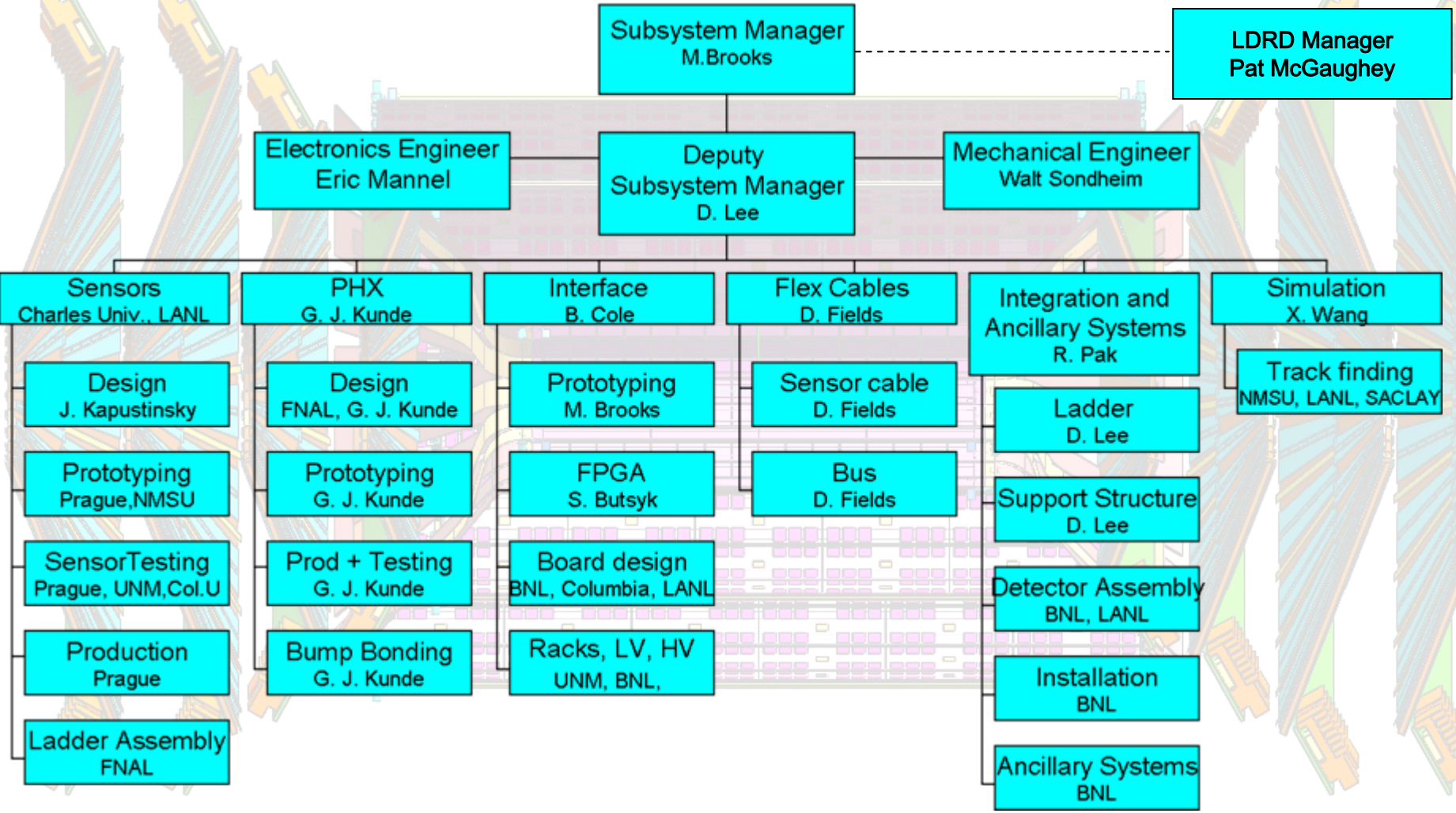
Committed Institutions

Los Alamos National Laboratory
Brookhaven National Laboratory
Columbia University
Iowa State University
Charles University, Czech Technical University, Institute of Physics, Academy of Sciences, Prague
New Mexico State University
University of New Mexico

Interested Institutions

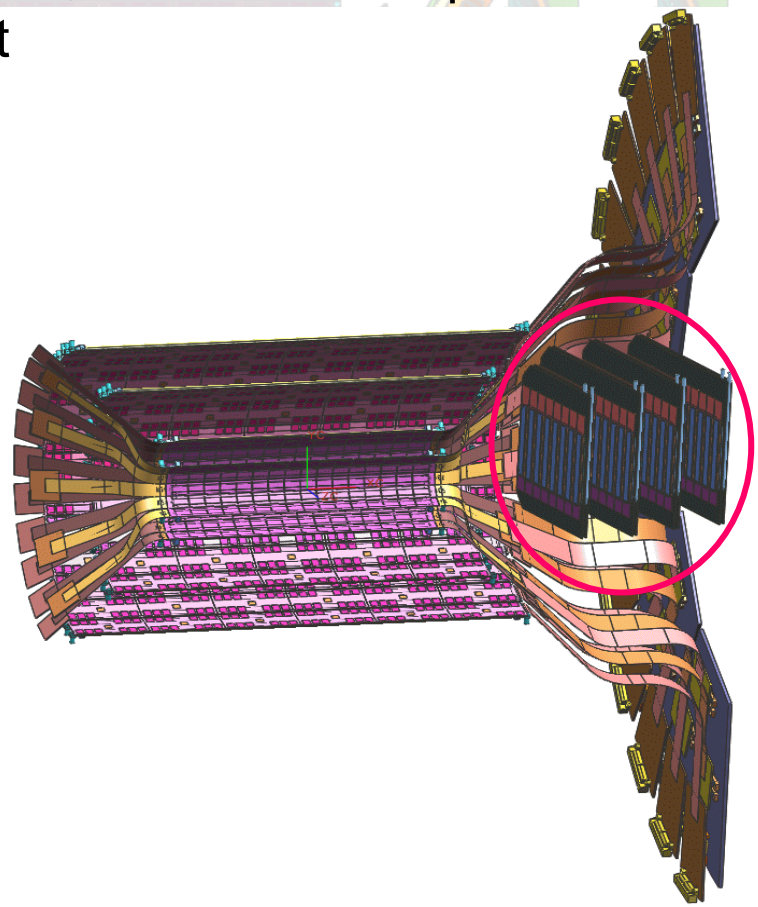
Ecole Polytechnique, Saclay
Florida State University
Korea University
Yonsei University, Seoul, Korea

Who?


Subsystem Manager
M.Brooks
LDRD Manager
Pat McGaughey
Electronics Engineer
Eric Mannel
Deputy
Subsystem Manager
D. Lee
Mechanical Engineer
Walt Sondheim
Sensors
Charles Univ., LANL
PHX
G. J. Kunde
Interface
B. Cole
Flex Cables
D. Fields
Integration and
Ancillary Systems
R. Pak
Simulation
X. Wang
Design
J. Kapustinsky
Prototyping
Prague,NMSU
SensorTesting
Prague, UNM,Col.U
Production
Prague
Ladder Assembly
FNAL
Design
FNAL, G. J. Kunde
Prototyping
G. J. Kunde
Prod + Testing
G. J. Kunde
Bump Bonding
G. J. Kunde
Prototyping
M. Brooks
FPGA
S. Butsyk
Board design
BNL, Columbia, LANL
Racks, LV, HV
UNM, BNL,
Sensor cable
D. Fields
Bus
D. Fields
Ladder
D. Lee
Support Structure
D. Lee
Detector Assembly
BNL, LANL
Installation
BNL
Ancillary Systems
BNL
Track finding
NMSU, LANL, SACLAY

LDRD Forward Silicon Project from LANL

- Approximately one octant's worth of silicon tracking provided within 3 years
- BTeV-designed silicon and readout chip used, but readout chip will have almost identical digital section to this project
- Much Shared R+D:
  - All DAQ interface efforts will be directly applicable to FVTX project
  - Pixels rather than mini-strips→similar number of channels and cards to deal with as FVTX project
  - Experience from data analysis will be directly applicable



Cost and Schedule for FVTX

Schedule:

LANL and BNL R+D required

- Design and prototype chip+ silicon now→ 12/07
- Design and prototype DAQ interface now→ 05/07

Construction:

- Production + assembly 11/07→08/10
- DAQ Interface, LV, HV… parallel
- Installed 10/10

Cost

LANL R+D:	$360k
BNL R+D:	$495k
Construction:	$3.58M + 27% contingency = $4.5M

Details in Cost and Schedule talk

Review Schedule

The FVTX upgrade project	Melynda Brooks (15 minutes)
Physics with the FVTX	Mike Leitch (20 minutes)
Simulated Performance	Xiaorong Wang (30 minutes)
Detector technology	Gerd Kunde (35 minutes)
Interfacing to PHENIX DAQ	Brian Cole (15 minutes)
Integration into PHENIX	Robert Pak (15 minutes)
Cost & Schedule	Melynda Brooks (20 minutes)